

IDENTIFICATION OF LARVAE OF TWO EUROPEAN SPECIES OF  
CEUTORHYNCHINAE (COLEOPTERA: CURCULIONIDAE) FOUND  
IN *CARDUUS MACROCEPHALUS* DESFONTAINES (COMPOSITAE)

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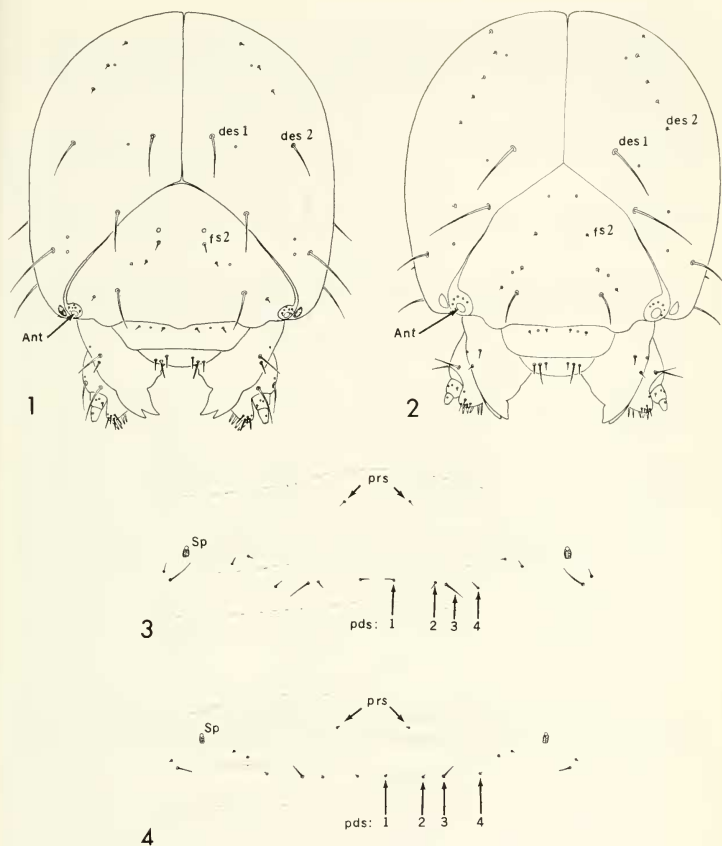
**Abstract.**—Larvae of *Ceutorhynchus trimaculatus* Fabricius and of *Ceuthorhynchidius horridus* (Panzer), both potential biocontrol agents against the thistles *Carduus macrocephalus* Desfontaines and *C. thoermeri* Weinmann, were difficult to separate on the basis of feeding habits because they are found together in the crowns of the rosettes, but now they can be identified on the basis of anatomical characters presented in a key and table of measurements. The separation of these larvae from those of other weevils known to attack these thistles is also discussed.

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*Ceuthorhynchidius horridus* (Panzer) and *Ceutorhynchus trimaculatus* Fabricius are potential biocontrol agents against *Carduus macrocephalus* Desfontaines and *C. thoermeri* Weinmann in North America. *C. horridus* has already been released in Virginia (Kok et al., 1975), and *C. trimaculatus* is currently being studied in Europe (Boldt, 1978) and in Virginia (Kok, 1978), in order to gain approval for its release in the United States. The larvae of both species are found together in the crowns of the thistle rosettes, and therefore cannot be identified to species by their location in the plants. To study the biology of these weevils and to evaluate their biocontrol potential under natural field conditions in Europe, it is necessary to know the taxonomic characters by which their larvae can consistently be separated. Therefore, taxonomic comparisons of larvae of the 2 species were undertaken, and the resulting key, measurements, and discussion are presented in this paper.

MATERIALS AND METHODS

Adults of *C. trimaculatus* and *C. horridus* were field collected on rosettes of *C. macrocephalus* near Rome, Italy, in November and December, 1976.



Figs. 1–2. Heads of larvae, front view. 1, *Ceutorhynchus trimaculatus*. 2, *Ceuthorhynchidius horridus*. Figs. 3–4. Abdominal segment 2 of larvae, dorsal view, flattened by slide-mounting. 3, *Ceutorhynchus trimaculatus*. 4, *Ceuthorhynchidius horridus*. Abbreviations: Ant, antenna; des 1, dorsal epicranial seta 1; des 2, dorsal epicranial seta 2; fs 2, frontal seta 2; pds, postdorsal setae; prs, prodorsal setae; Sp, spiracle.

Females were separated by species and caged for oviposition on bouquets or on small thistle plants held in the laboratory. Live eggs, 0–48 hours old, and head capsules of larvae preserved in 70% alcohol, were measured at 50 $\times$  with an ocular micrometer in a stereoscopic microscope. A few larvae of each instar were dissected, macerated in a warm NaOH solution, slide-

mounted in glycerine, and examined with a compound microscope at 100–400×. Undissected specimens were studied with a stereoscopic microscope. Illustrations were made from slide-mounted and unmounted mature (3rd instar) larvae. The larval terminology used in the key and illustrations follows that of Anderson (1947).

The larvae upon which the key is based are in the National Museum of Natural History, Washington, D.C. All of the larvae and eggs from which measurements were taken are in the collection of the Biocontrol of Weeds Laboratory, USDA, in Rome, Italy.

MEASUREMENTS

Measurements of head capsule width indicated the presence of three larval instars. The egg and head capsule size in mm were as follows:

	Mean ± S.D.	No.	Min.	Max.
<i>Ceutorhynchus trimaculatus</i>				
Eggs: Length	0.66 ± 0.04	59	0.58	0.71
Width	0.36 ± 0.02		0.34	0.37
1st instar	0.32 ± 0.02	36	0.29	0.36
2nd instar	0.48 ± 0.03	35	0.43	0.52
3rd instar	0.69 ± 0.03	41	0.62	0.72
<i>Ceuthorhynchidius horridus</i>				
Eggs: Length	0.53 ± 0.03	44	0.45	0.58
Width	0.34 ± 0.03		0.31	0.41
1st instar	0.28 ± 0.02	79	0.24	0.32
2nd instar	0.43 ± 0.02	17	0.40	0.47
3rd instar	0.66 ± 0.03	12	0.62	0.71

The egg and head capsule widths at each instar of the two species are similar although *C. trimaculatus* specimens average slightly larger than *C. horridus*. Head capsule widths for *C. horridus* are similar but slightly larger than measurements by Kok, et al. (1975).

KEY TO SEPARATE LARVAE OF *CEUTORHYNCHUS TRIMACULATUS*  
AND *CEUTHORHYNCHIDIUS HORRIDUS*

Successful use of this key requires dissection and clearing of the specimens and preparation of slide mounts of the heads and skins, so that the characters mentioned can be studied with a compound microscope.

- Dorsal epicranial seta 2 (des 2) of the head long, subequal in length to dorsal epicranial seta 1 (des 1); frontal seta 2 (fs 2) of head short but clearly visible (Fig. 1); prodorsal setae (prs) and postdorsal setae (pds) 1, 2, and 4 of abdominal segments 1–7 approximately ½ the length of postdorsal seta 3 (Fig. 3) ..... *Ceutorhynchus trimaculatus* Fabricius

- Dorsal epicranial seta 2 of head very small, appearing absent at low magnifications, and much shorter than epicranial seta 1; frontal seta 2 of head very short, visible only at high magnifications (Fig. 2); prodorsal setae and postdorsal setae 1, 2, and 4 of abdominal segments 1-7 very short, much less than half the length of postdorsal seta 3 (Fig. 4) . . . . . *Ceuthorhynchidius horridus* (Panzer)

## DISCUSSION

The foregoing key is intended for use in areas of Europe and North America where larvae of the two species treated are known to occur in the crowns of musk thistles. Larvae of other curculionid genera may also be found attacking various parts of *Carduus macrocephalus* plants (Boldt and Campobasso, 1978), but these larvae are normally not found in the crowns. The larvae of *Apion* and *Lixus* species are usually found burrowing in the stems above the crowns; larvae of *Rhinocyllus* and *Larinus* species are usually found in flower heads, and those of *Cleonus* species usually burrow in the roots below the crown. In addition to the clue provided by the part of a *Carduus* plant attacked by the larvae, an anatomical character that can be used to distinguish larvae of *Ceutorhynchus* and *Ceuthorhynchidius* species from those of the other genera mentioned is the shape of the accessory appendage of the antenna. As described by van Emden (1952) in his key to larvae of major groups of Curculionidae, the accessory appendage of the antenna (or "antenna" of van Emden) has a semi-globular shape in all larval Ceutorhynchinae versus a distinctly more elongate or more compressed shape in larvae of other groups of weevils. In larvae of *C. trimaculatus* and *C. horridus*, this character is as shown in Figs. 1 and 2 (Ant). The antennae of larvae of species of *Apion*, *Lixus*, *Rhinocyllus*, *Larinus*, and *Cleonus* have subconical or spindle-shaped accessory appendages, as in figures published by Scherf (1964) of heads of larvae of those genera.

## ACKNOWLEDGMENTS

We wish to thank Gaetano Campobasso for technical aid at the Biological Control of Weeds Laboratory, SEA, USDA, in Rome. We are also grateful for the comments received from Wayne E. Clark, Ronald W. Hodges, John M. Kingsolver, and F. Christian Thompson, who reviewed the first draft of this paper. All illustrations were prepared by Candy Feller, Systematic Entomology Laboratory, SEA, USDA, Washington, D.C.

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